

to him, though he was not visible to me. I have often very much regretted that I have not been brought into closer relations with this large body of earnest men and students. Still, among those whom I have known I have found many esteemed friends. I do not think it desirable for me to make further remarks, beyond expressing to Mr. Collier my appreciation of his success in making what is not an ugly portrait out of such an ugly face as mine.

The proceedings then terminated.

In the evening Dr. Williamson was entertained at dinner at the Freemasons' Tavern by a goodly number of his friends and old pupils. Sir Henry Roscoe presided. After the toast of the Queen had been given and duly honoured, Mr. Carteighe, one of the honorary secretaries, announced that a considerable number of letters from subscribers had been received, expressing their regret at not being able to be present. The one from Prof. Michael Foster, F.R.S., referred humorously to Dr. Williamson as the "Ether Meister."

Sir Henry Roscoe, in proposing the toast of the evening, "Our Guest" (Dr. Williamson), alluded in kindly and affectionate terms to his early association with him, to his enthusiasm as a teacher, and to the respect in which he was held by men of science all over the world.

Dr. Williamson, in replying, expressed the gratification which their hospitality and kindness had afforded him, and referred with pride and satisfaction to the great honour which had been conferred upon him in the presentation of his portrait to University College. In conclusion, he invited any of his old pupils, present and absent, when in the neighbourhood of Hindhead to call and see him in his "nest."

Mr. Norman Lockyer, F.R.S., proposed "University College and its President," and Mr. J. Eric Erichsen, F.R.S., the President, replied.

Prof. W. H. Flower, F.R.S., submitted "The Professors of University College." Prof. Henry Morley responded for the Arts Faculty, and Prof. G. C. Foster for that of Science.

Prof. Ramsay, F.R.S., proposed "The Chairman," and Sir Henry Roscoe, M.P., responded.

Prof. T. E. Thorpe, F.R.S., proposed "The Committee of the Williamson Testimonial," to which Mr. Michael Carteighe, President of the Pharmaceutical Society, and Dr. H. Forster Morley, the honorary secretaries, replied.

THE MORPHOLOGY OF BIRDS.¹

II.

THE second part of vol. ii. is taxonomic and systematic. The author criticizes and tests the taxonomic value of the numerous characters of all the organic systems; each paragraph forms therefore a condensed *résumé* of our present knowledge of the various organs, with especial reference to those parts which proved to be of more than ordinary taxonomic importance. The question if an organ is of taxonomic value at all does not depend upon the presence or absence of the organ itself, but upon what it is like. Hence the weakness of those systems which have been based upon positive and negative characters only; even Garrod failed, since he took for his guidance not quality, but merely quantity. Those organic characters are preferable which exhibit a certain amount of differentiation, but which at the same time do not vary much within the limits of smaller groups of birds. Through combination of a considerable number of such characters, to be taken from organs between which there

can be but little correlation, we have the best chance of arriving at a sound system. But of such characters there are, unfortunately, few.

However, on pp. 1580-91, Fuerbringer has selected forty-eight characters, not all, of course, of equal value, and has arranged them in tabular form, together with the ninety families into which he divides the birds. Especial attention may be drawn to the second column, which contains the first known occurrence of fossil members of each of the families. This column, together with the remarks on pp. 1107-10, and the discussions under the heading of each family in the special systematic part of the book, contains the only complete and critical essay on fossil birds that has yet been published.

But it is impossible to give here anything besides occasional hints about the vast amount of thought which the author has bestowed upon nearly all the organic systems, always on the look out for characters which might perhaps prove constant enough to act as guides amongst the chaos of the natural affinities of birds, always awake where great adaptiveness or convergence of forms might easily lead us astray.

Bill and feet proved to be of comparatively little value, in spite of their historical significance; the same applies to the oil-gland; whilst pterylosis is never to be neglected, especially that of the embryo.

Oology.—The size of the eggs depends upon the terrestrial, aquatic, or aerial life of the birds. Those which make their nests in high trees lay, as a rule, smaller eggs, and are "altrices"; whilst those which lay the eggs on the ground, and are "precoces," have more and larger eggs. Thickness of the shell, or the weight of the egg, often depends upon the smaller or greater liability of the eggs to external injury. The colour of the eggs stands, like that of the female bird, in correlation with the configuration of the nest, and affords good characters for classification. The best character, however, is formed by the finer structure or texture of the shell, since this remains unchanged in the species, and can also successfully be used for the recognition of wider relationship.

Skeletal System.—The importance of relative measurements has induced the author to look for a unit applicable to all birds. This he finds ingeniously in the average length of the dorsal vertebræ, because of the constancy of these parts. The numerous tables, which contain (pp. 794-800) an enormous number of measurements, have shown, however, that their taxonomic value is but very limited. The total number of vertebræ is inconstant even in the individual, and varies in larger groups to such an extent (*Limicolæ* 43-50, *Anseres* 50-63) that it can hardly be used in determining the systematic position of a given bird. Better results are yielded by the numbers of the cervical, thoracic, and sacral vertebræ alone, and their proportionate quantity, cf. Table xxii. pp. 778-79.

In the configuration of the sternum, the anterior margin, with its spine, is the most noteworthy point.

Of greater value is the configuration of the maxillo-palatine apparatus, as was first pointed out by Nitzsch, J. Mueller, and especially by Cornay in 1847. Huxley's classification, based upon these characters, in 1867, marked an epoch in the systematics of birds; but it is artificial, not natural, as the numerous exceptions and intermediate stages show, which have been discovered by later anatomists. The basipterygoid processes likewise afford gradual differences only. The whole maxillo-palatine apparatus is far too adaptive to permit of its use as a safe guide in classification.

The hyoid bones afford a rather good generic, and occasionally even a family character.

The size of the coraco-scapular angle depends in inverted ratio upon the development of the shoulder-muscles. This, with the various dimensions of the scapula, the processes and foramina of the coracoid, &c., receive special attention in the tabular lists, pp. 738-57,

¹ "Untersuchungen zur Morphologie und Systematik der Voegel. zugleich ein Beitrag zur Anatomie der Stuetz- und Bewegungsorgane." Von Max Fuerbringer, Professor der Anatomie, und Direktor des anatomischen Institutes und des Museum Vrolik der Universitaet zu Amsterdam. Mit 30 Tafeln. (Amsterdam: T. van Holkema, 1888.) Continued from p. 152.

and in the text of the osteological part of the book. Table xxxvii. contains the length of the humerus in units of dorsal vertebrae.

Pp. 1042-47 form a condensed essay on the pelvis. The difficulties of homologizing its constituent parts with those of other Vertebrata are pointed out, but they are not solved. The pelvis, as a whole, has never been tested sufficiently as to its taxonomic value, and the adaptability of the limbs, both anterior and posterior, warns us not to lay too much stress upon these parts either.

Pp. 1053-66.—Fuerbringer points out which muscles are of systematic importance, also how far and in which groups of birds he found them to be so.

The results yielded by the most extensive examination of the brachial plexus (pp. 232-80, Plates 8-10) are morphological only, but of no taxonomic value.

In his treatment of the sense-organs, the digestive, vascular, excretory, and reproductive systems, he gives only a more or less cursory review of the work of other anatomists. The organs of voice and respiration receive more attention. The author distinguishes between (1) syrinx trachealis, possessed by the Passeres tracheophonæ, and in a less finished degree by certain Pelargi; (2) s. tracheo-bronchialis (Psittaci, Passeres, Pseudoscines = Menura and Arctichia); (3) s. bronchialis, many Cuculidæ, Caprimulgidæ, Strigidæ, &c.

Concerning the ontogenetic development of birds, Fuerbringer has been struck with the extraordinary resemblance which the embryos of certain families exhibit to each other before the divergence of the final formation of beak and feet has been fixed. Thus, Laridæ and Limicolæ, Pici and Passeres, Striges and Caprimulgidæ, indicate in these stages close relationship.

Remarkable, although rather short (pp. 1107-19) are the chapters on palæontological development and on geographical distribution. The hypothetical division of the world into Arcto- and Neogæa is not favoured, whilst Lemuria is justly re-established. Explanations of the present distribution of the Ratitæ, Spheniscidæ, Rasores, Passeres, and other principal orders are attempted, and if not always successfully solved, are at least partly cleared up by the allusion to fossil intermediate forms.

The cradle of the Passeres is very old, of Cretaceous age, and existed probably in the Oriental region; the Eurylamidæ still exist as the last and least modified descendants of the primæval Passeres. Thence they spread all over the globe. About the beginning of the Miocene age one stock branched off, likewise in the Oriental region, as the Oscine type, the numbers of which conquered the world, with the exception of the Neotropical region, which they reached last, and found already fully occupied by their older but highly developed relatives the Oligomyodi and Tracheophones.

The outcome of all this work is a most elaborate systematic arrangement of birds, recent and extinct. This occupies pp. 1136-1591.

Family after family is discussed as to its characters, affinities, distribution, first fossil occurrence, and the position it held in the opinion of previous ornithologists and anatomists.

Fuerbringer's system of birds is almost entirely new, less striking in the arrangement of the families and the placement of odd or solitary genera than in the disposal of the whole host of birds into a few large orders. Such a grouping together has been a long-felt desideratum, because the close adherence to the principle "*Divide et impera*" has led to a splitting up of the birds into an ever-increasing number of groups, whilst their combination into greater phyla was in danger of being lost sight of.

This want of generalization made us hail the terms Schizo-, Desmo-, Ægitho-gnathæ; but they were hardly established as household words amongst ornithologists

before Schizorhinæ and Holorhinæ, Homalagonatæ and Anomalagonatæ, went through their short-lived existence, and in their turn gave way to other principles of classification by Garrod and Forbes, which will easily be detected in the system now before us. The class Aves is divided into two sub-classes, eight orders, twenty-four sub-orders, forty-five gentes, and ninety families. The orders, especially the four into which the Carinatae are divided, represent such centres or phyla as we have been longing for, and around them are arranged other, mostly aberrant or much specialized, groups as "intermediary sub-orders." The orders end each in *-ornithes*, the sub-orders throughout in *-formes* (see table on next page).

This system of birds is graphically illustrated by two side views of an elaborate "ancestral tree," on Plates 27c, 28, and by three more plates which represent three horizontal sections through this ideal tree. The author justly insists upon the necessity of constructing such ancestral pedigrees in the three dimensions, and he has himself taken care to indicate isomorphism, *e.g.* Gypogeranus and Cariama, Procellariidæ and Steganopodes, by the convergence of the branches.

It is, of course, beyond the scope of this review to enter into many of Fuerbringer's ideas on the affinities of all the families of birds. Only those of general interest can here be dealt with.

The old group of the *Odontornithes* has properly been discarded; their constituent members have been distributed amongst the other birds. Probably all birds possessed teeth during the Cretaceous epoch.

Archæopteryx belongs to the primitive Carinate flying birds or Proto-Ptenornithes. It cannot be decided whether it is a direct ancestor of living Carinate birds; but there are no valid reasons why it should be looked upon as an intercalary type between reptiles and birds.

We learn more about the Ratitæ. They are Deuter-Aptenornithes, *i.e.* they are descendants of Ptenornithes, but have lost their power of flight. The differences between the various forms which are generally recognized under the name of Ratitæ are so great, that these birds cannot collectively be opposed to the Carinatae. Struthio, Rhea, and Dromæus Casuarius are each representatives of separate orders. Fuerbringer approaches the views of Sir Richard Owen, who more than twenty years ago suggested that the various Ratite birds are the descendants of several groups of the Carinatae, but that they have become modified in similar directions: their Ratite characters are cases of analogy, and do not indicate near relationship. The separation from the common Carinate stock took place very early, certainly as early as the Cretaceous epoch. The root of the Struthionithes perhaps contains fibres of the later Pelargornithes, whilst the Rheornithes and Hippalectryornithes have also some traces in common with the primitive or dawning Charadriornithes and Alektorornithes. Lastly, the New Zealand Ratitæ, Apteryx, and Dinornis resemble the Carinatae in so many features that they form only the sub-order Apterygiformes of the order Alektorornithes. The affinities of Apteryx with the Crypturi and Fulicariæ are even greater than those with the other Ratitæ.

For Carinatae the synonym Acrocoracoidæ has been invented, but the author does not see his way to accepting them as a separate sub-class, since he had to break up the Ratitæ.

The most primitive forms amongst the Ornithuræ are the American Cretaceous Ichthyornis and Apatornis. They differ from recent Carinate birds in degree only, viz. by their tormodont teeth and amphiœlous vertebrae. They stand nearest to the Laridæ, with touches of the Procellariidæ and Ciconiiformes.

Hesperornis has most probably lost the keel of its sternum, and in correlation with this loss has also acquired platy-

CLASSIS AVES.

I.—Subclassis Saururæ.

Order.	Sub-order.	Gens.
ARCHORNITHES	Archæopterygiformes	Archæopteryges.

II.—Subclassis Ornithuræ.

STRUTHIORNITHES	...	...	Struthioniformes	...	...	...	Struthiones.					
RHEORNITHES	...	...	Rheiformes	...	...	...	Rheæ.					
HIPPALECTRYORNITHES	...	Casuariiformes	...	...	...	...	Casuarii = Dromæus + Casuarius + Dromornis.					
	Intermed.	S.O.	Æpyornithiformes	...	...	...	Æpyornithes.					
	Intermed.	S.O.	Palamedeiformes	...	...	...	Palamedææ.					
PELARGORNITHES...			Anseriformes	...	...	...	{ Gastornithes.					
							{ Anseres s. Lamellirostrcs.					
							{ Enaliornithes.					
			Podicipitiformes	...	...	...	{ Hesperornithes.					
							{ Colymbo-Podicipites.					
							{ Phœnicopteri.					
			Ciconiiformes	...	...	...	{ Pelargo-Herodii.					
							{ Accipitres.					
							{ Steganopodes.					
		Intermed.	S.O.	Procellariiformes	...	...	...	Procellariæ s. Tubinæres.				
	Intermed.	S.O.	Aptenodytiformes	...	...	...	Aptenodytes s. Impennes.					
	Intermed.	S.O.	Ichthyornithiformes	...	...	...	Ichthyornithes.					
CHARADRIORNITHES			Charadriiformes	...	...	...	{ Laro-Limicolæ.					
							{ Parræ.					
							{ Otides.					
		Intermed.	S.O.	Gruiformes	...	...	...	{ Eurypygæ, incl. Rhinochetus, Aptornis.				
								{ Grues = Grus + Psophia + Cariama.				
		Intermed.	S.O.	Ralliformes	...	...	...	{ Fulicariæ = Heliornis + Rallidæ.				
								{ Hemipodii = Mesites + Hemipodiidæ.				
	ALECTORORNITHES			Apterygiiformes	...	...	...	{ Apteryges = Apteryx + Dinornis.				
								{ Crypturi.				
								{ Gali = Gallidæ + Opisthocomidæ.				
		Intermed.	S.O.	Columbiformes	...	...	...	{ Pterocletes.				
								{ Columbæ.				
								{ Psittaci.				
		Intermed.	S.O.	Psittaciformes	...	...	...					
			Coccygiformes	...	...	...	...	{ Coccyges = Musophagidæ + Cuculidæ.				
								Intermed.	G. Galbulæ, incl. Bucconidæ?			
		Pico-Passeriformes	...	...	...	...	{ Pico-Passeræ. { Pici.					
							{ Makrochires.					
							{ Colii.					
CORACORNITHES			Halcyoniformes	...	...	...	Intermed.	G. Trogones.				
												{ Halcyones.
												{ Bucerotes, incl. Upupa.
	{ Meropes.											
								Intermed.	G. Todii.			
			Coraciiformes	...	...	...	...	{ Coraciæ.				
								{ Caprimulgi.				
								{ Striges.				

coracoidal features; it would therefore have to be grouped with the Ratitæ if we wanted to degrade this expression to a collective term for cases of converging analogies or isomorphism, and thus deprive it of any phylogenetic meaning. The characters which mark Hesperornis as an Aptenornith are secondarily acquired, whilst all the rest of the skeletal characters indicate its close affinity with the European Enaliornis, and amongst recent birds with the Colymbidæ and Podicipedidæ. This relationship receives its final expression by the establishment of the order Podicipitiformes.

These Podicipitiformes, with the Anseriformes and with the Ciconiiformes, are combined in one big order, *Pelargornithes*. In proportion as the first two of these orders appear circumscribed and natural the Ciconiiformes appear heterogeneous. They are made to contain the Phœnicopteri, Pelargo-Herodii, Steganopodes, and the Accipitres or diurnal birds of prey. The close affinity of the Phœnicopteri with the Pelargi is beyond doubt, and so is that of the Storks and Herons, and that of the latter with the Steganopodes. But how the Accipitres should be related to the other three or four gentes seems less clear. However, we must not forget that already Garrod

had arrived at similar conclusions. Fuerbringer holds that the Cathartidæ are a very old and now declining Raptorial family, and that they have many structural points in common with the Ciconiidæ, whilst the Gypofalconidæ exhibit genetic relations with the Steganopodes (Fregata) and with the Ardeidæ. Gypogeranus had formerly (Miocene of France) a much wider distribution than now, and it is the last remnant of a group which branched off from the common Accipitrine Stork before the division into Cathartidæ and Gypofalconidæ took place.

Steganopodes are known to have existed in the earliest Eocene period, and are now on the decline; lowest amongst them stand now the Phætonidæ, highest the Fregatidæ. Their rather striking affinities with the Accipitres have already been mentioned, perhaps they are as distantly connected with the Pelargo-Herodii.

Pelargo-Herodii.—Plataleidæ form the lowest type, and afford some points of connection with the Limicolæ; Ardeidæ, the highest and most flourishing family, exhibit various characters by which we might trace their pedigree towards the roots of Colymbus, Haliaetus, Falco, and others. This diversity of connections indicates either

that the Pelargo-Herodii are an extremely old group, which has preserved features common to all the other Pelargornithes, or that the division into the various much specialized gentes took place rather recently. Fossil material seems to favour the latter view, and this circumstance probably explains why the Ciconiæ have more in common with the Cathartidæ, whilst the Ardeæ approach the Steganopodes and Falconidæ. Why the Flamingoes should be elevated to the rank of a gens does not appear clear, considering their close genetic connection with the Pelargi, especially through the Miocene Palæodus.

Anseriformes.—Probably an old and small pre-Miocene group, which has marked its broader development more recently. The Eocene Gastornis seems to have been a gigantic type, which had lost its power of flight, like the diluvial Cnemiornis of New Zealand. Amongst recent Lamellirostres, Mergus is the lowest, Cygnus the highest type; they are distantly related to the Podicipitiformes.

Palamedeiformes show many connective points with the Anseres, Steganopodes, and Pelargo-Herodii, but their reception into the Pelargornithes is rendered impossible by various fundamental and primitive peculiarities. Through their intestines and pterylosis they somewhat resemble Rhea. Whether we place them nearer to the Anseres than to the Pelargi and Steganopodes depends upon the taxonomic value which we happen to attribute to their skeletal, muscular, intestinal, or external features.

The Antarctic *Aptenodytiformes*, s. Spheniscidæ, are a very old family, because the genus *Palæodyptes* shows that they had become specialized into diving and swimming birds with total loss of the power of flight in the Eocene period, or probably even earlier. Fuerbringer calls the Penguins Trit-Aptenornithes, indicating that they, like the Great Auk, the Dodo, Ocydromus, and others, have lost their power of flight later than the Ratitæ. A sharp line between Deutero- and Trit-Aptenornithes cannot, however, be drawn, since Cnemiornis, Gastornis, &c., are intermediate forms, just as Stringops is now on the way to become Aptenornithic.

Many of the characters of the Penguins generally considered as primitive are partly "pseudo-primitive," i.e. phylogenetically reduced and ontogenetically retarded; e.g. the structure and distribution of the feathers, the fin-like anterior extremities, the broad scapula, and, according to Fuerbringer, even the metatarsus. The resemblances with Podiceps and Colymbus are superficial only, but he cannot tell to which of recent birds the Penguins approach nearest. All that the author contends against is the removal of the Penguins into a sub-class, equivalent to the rest of the Carinata. On Plate 29a they are represented as a lonely group.

The *Procellariiformes*, or Tubinares, have likewise the rank of a sub-order, intermediate between Steganopodes, Ichthyornis, Spheniscidæ, and Charadriiformes. They are certainly a very old and now isolated group.

The large order of the CHARADRIORNITHES has split into aquatic and gralline types. The Alcidiæ are closely allied to the Laridæ, and are probably the most recent of those birds which have assumed a pre-eminently aquatic and diving life, with correlated reduction of the wings. They are restricted to the periarctic zones of the northern hemisphere, whilst their relatives, the Gulls, enjoy a cosmopolitan range. There can be but little doubt that the oldest *Charadriiformes* were gralline, so that the Otides, with *Edicnemus*, Parra, and the Thino-coridæ, stand nearer the common stock than the more specialized aquatic members.

The *Gruiformes* are connected with the Charadriiformes by Eurypyga, with the Ralliformes by Aramus. They seem to have reached their culminating period in the Miocene age. *Dicholophus* is the most highly-specialized form, and has assumed peculiar Raptorial characters isomorphic with those of *Gypogera*, which is a true bird of prey.

The *Ralliformes* flourished as early as the Eocene period. The Fulicariæ, consisting of the Rallidæ and Heliornis, are more nearly related to the Hemipodii than to the Crypturi. The sub-order of the Ralliformes takes, therefore, a position intermediate between Gruiformes, Crypturiformes, and Apterygiformes.

The latter two sub-orders, together with the Galliformes, constitute the order ALECTORORNITHES.

The relationship of the Crypturi with the Apteryges is real, and bridges over the gulf between Carinate and Ratite birds, especially through cranial and pelvic structures.

The *Galliformes* proper consist of three families: Megapodii, of Austro-Malayan distribution; Neotropical Cracidæ; and universal Gallidæ. The two former exhibit so many important differences in their soft parts that, in spite of their numerous skeletal resemblances, they cannot be opposed to the rest of the Fowls as Peristeropodes. Closely allied to the Galli is *Opisthocomus*, an old type now dying out; the last solitary species has reached a high degree of one-sided specialization, which elevates this bird above its nearest allies to the level of low arboreal birds.

Columbiformes stand between Charadriiformes and Peristeropodes, perhaps nearer the former through the Pterocletes, which are undoubtedly the more primitive group, whilst Columbæ, beginning with the Miocene only, are still on the ascending scale, and are birds of the future. *Didus* and *Pezophaps* are degenerate Columbæ, not necessarily very old forms.

Psittaciformes.—The affinities of the Parrots have puzzled Fuerbringer as much as other ornithologists. He places them as an intermediate sub-order, like the Columbiformes, between the Alectorornithes and Coracornithes. Our knowledge of fossil Parrots is very defective. They existed in the Lower Miocene of France, typically developed; now they are a large, numerous group of birds, with more than intertropical range, and with no living members through which they approach other groups.

The last great order is that of the CORACORNITHES.

The *Cuculiformes* = Musophagidæ and Cuculidæ, are connected with the ancestral Limicolæ and Galli; however, their roots meet so distantly, certainly not later than the earliest Eocene period, that these birds have gone along parallel lines of development since those remote times, and that the Cuculiformes cannot be classed with either Galliformes or Charadriiformes. Their original centre was probably the Oriental region, whence they spread chiefly in Western directions.

The *Coraciiformes* are relatively least removed from the Charadriiformes. The Coraciæ represent the lowest group of arboreal birds, and are related to the Caprimulgi, more remotely to the Owls, Trogons, and Bee-eaters. The Caprimulgi include necessarily the Podargidæ and Steatornithidæ, whilst their apparent similarity with the Cypseli rests chiefly upon secondary analogies. The same applies to the Striges with reference to the Accipitres. Owls have so many important points in common with the Coraciæ (*Leptosomus*), and especially with the Podargidæ, that they have to be looked upon as Raptorial Coraciiformes or "Podargoharpages."

Halcyoniformes.—The Halcyones, Meropes, and Buccones—the latter of course including Upupa—form a pre-eminently palæogæic group of syndactylous birds. The Todi, including the Motmots, connect them with the previous and with the next following sub-order. The same applies to the Trogons.

Pico-Passeriformes.—This large sub-order contains the Pico-Passeres, Makrochires, and the Colii. The Colii have frequently been classed with or near the Musophagidæ, Fuerbringer thinks owing to superficial analogies only. They are now a very lonely little group in the Ethiopian region, without any known history, or without

satisfactory indications of their pedigree, their affinities with the Cypseli being perhaps the least far-fetched.

The *Makrochires* = Cypselidæ + Trochilidæ, prove to be far more closely related to the Passeres than to the Caprimulgi. The old group of the "Cypselomorphæ" had therefore to be broken up.

Pico-Passeres.—Very intimate relationship connects the Indicatoridæ, Capitonidæ, Rhamphastidæ, and the Picidæ to one group—*Pici*. Primitive Pici existed in the Eocene age; many threads bind them to the Galbulæ and to the Halcyones, still more to the Pseudoscines.

Passeres.—They represent the highest types which the avian stock has as yet developed. In spite of their enormous number of genera and species, which surpasses that of all the rest of the birds, they agree so closely with each other in all their principal and primary characters that the Passeres proper are morphologically only of the value of one family. This uniformity has naturally always rendered their further classification very difficult.

Fuerbringer divides them as follows, in close conformity with the views held by most English ornithologists.

I. Family *Pseudoscines* = *Atrichia* + *Menura*.—They are types which are now dying out, and which differ from all other Passeres through those characters which they have in common with the Pici.

II. Family *Passeridæ*, with four sub-families.

(1) *Desmodactyli* = *Eurylæmidæ*.—They differ fundamentally from the *Coraciæ*, and are the last remnants of the oldest Passerine forms.

(2) *Oligomyodi*.—Their wide distribution—e.g. *Pitta* in the Oriental and Ethiopian regions, *Xenicus* in New Zealand, the overwhelming majority in the Neotropical region—sufficiently indicates the extreme age of the *Oligomyodi*, and sufficiently accounts for the great diversity in the development of the syrinx, podotheca, and femoral artery, &c., which makes these birds appear a rather heterogeneous group.

(3) *Tracheophones*.—The tracheophonous syrinx, and the entirely Neotropical distribution of the *Conopophaginæ*, *Pteroptochinæ*, *Formicariinæ*, *Furnariinæ*, and *Dendrocolaptinæ*, suggest a monophyletic origin of these birds from lower American *Oligomyodi*.

(4) *Oscines* s. *Acromyodi*.—This family forms what may be called the topmost branches of the avian tree, with the *Corvinæ* as its culmination. It is characterized by the diacromyodean syrinx, and by the bilaminate covering of the tarsus. The latter feature occurs, however, also in the tracheophonous genus *Heterocnemis*, and is absent in the *Alaudinæ*.

Regarding the development of these four sub-families of the *Passeridæ*, the reader may be referred to a previous page (p. 178) of this summary.

Most probably all birds are the descendants of one reptilian form, though of which we do not know. The first lizard-like birds were small, and very likely terrestrial. They diverged into climbers on rocks and trees, and into inhabitants of swampy regions. The latter stock gave rise to swimming birds. The first birds were not vegetable feeders, as is generally supposed, but lived on insects and other small Invertebrata.

Lastly, there arises the question: What are the reasons for the natural extinction of large birds? Not predestination or catastrophes.

High differentiation, possible only through the one-sided development of certain organic systems and correlated regressive metamorphosis of the others, has, in the older groups of birds, frequently led to increased size of the body. This size, although securing a predominant position to the birds for the time being, inevitably implies the turning-point in the height of their development. Large or highly specialized animals will be least able to adapt themselves to further changes of their never-stationary, ever-changing surroundings, because, through their very one-sidedness, the retrograded as well as the

most specialized organs have rendered the whole organism more fixed than is the case with lower or less differentiated and therefore still plastic contemporaries. Amongst the younger groups of birds such a large size as is common amongst old and isolated types has not yet been reached, and probably will always be avoided. Small, but equally developed, will be the birds of the future.

So far so good. But with all this praise, are there no faults in Prof. Fuerbringer's work? Certainly, there are some. Its greatest fault may be indicated and at the same time explained in one sentence. If the author had been able to devote another year's labour to his "*Epoche machenden Untersuchungen*," he probably would have written a smaller book.

H. GADOW.

MUSINGS ON A MEADOW.

TO the general observer nothing in the way of vegetation would appear to present so few aspects, so limited a scope to the imagination and the associative faculties, as an expanse of herbage; and yet, perhaps, nothing that bountiful Nature has provided for the use and service of men so teems with the variety of associations that it presents to each different mind.

The farmer, whether he be the farmer of England, the wandering Bedouin, or the ranch-man of the New World, looks at the broad pastures and far-stretching plains, but not to admire the mingled masses of gorgeous colours, nor to speculate upon the battle that may have been fought upon this spot or the scenes that have happened there in former times, not to separate the numerous varieties of grasses into their many botanical genera and species, but to calculate how many sheep he can feed to the acre upon it, whether there is enough of white clover to fatten his camels upon, or whether his horses will have a sufficiency of suitable food to graze upon. The wide wild waste of endless lines of pale yellow, red, and gray, conveys no pleasure, but merely the indication of a good soil; and the buttercups and daisies he sees in the pasture meadows of England, hallowed by songs and memories, are to his economic eye positively offensive; knowing, as he does, that the older these buttercups grow, the more distasteful they become to stock, but never stopping to discover that it is because they become more acrid. To him it would seem a species of legerdemain if a botanist were to say to him, pointing to a buttercup, "Dig that up, and you will find a tuber at the root," and were then to select another, apparently similar in appearance to the former, and were to tell him that it had no tuber at the root; for from his eyes are completely hidden those minute differences so easily seen by the specialist between *Ranunculus bulbosus* and *Ranunculus acris*.

The botanist, on the other hand, as his eye rests on the same spreading plains of green, is utterly regardless of the feeding value of the plants that he sees before him. As he wanders from country to country, his eager eye detects the diminution or increase of particular species in different latitudes and altitudes, searching out the truths of Nature, or watching with a view to the confirmation of some pet theory. His mind ranges over the different prairies, plains, and meadows of the world. Again the battle of plant life is waging for him. His delight is unbounded. Every plant has its own history, so evident to him, so abstruse to the mere superficial observer; and, involuntarily, associations crowd upon his mind, of some musty tome perchance, or some ancient and not very accurate plate, or some amusing anecdote. For example, the cactus in the plains of Arizona or Texas reminds him of the many times he has seen this genus portrayed in pictures of the Holy Land at the time of the Founder of Christianity, and how, even in books pretending to be learned, he has met with it in the description of the plants of Syria of 2000 years ago, although, as a matter of sober history, this